Appendix I—Examples of Local Maps of Area-Wide Soil Contamination

Appendix I—Contents

Example Local (Tier 2) Maps of Area-Wide Soil Contamination

This document contains examples of the types of local (tier 2) maps that the Task Force recommends local jurisdictions and other consider. These maps show estimates of the areas potentially affected by area-wide soil contamination from historical smelter emissions and the historical application of lead arsenate pesticides on orchards, based on information currently available.

Example Smelter Emissions Maps

- Figures I-1 through I-4 show areas potentially affected by historical emissions from metal smelters in Tacoma, Everett, Harbor Island, Northport, and Trail, BC. The smelter emissions maps for the smelters in western Washington are based largely upon mapping and sampling efforts associated with ongoing cleanup actions; these figures include wind-rose diagrams illustrating the predominant wind patterns around the smelter sites. The smelter emission map for the Northport and Trail, BC smelters (Figure I-4) is based upon a historical study of the observed effects of sulfur dioxide emissions (another smelter emission contaminant released along with arsenic and lead) on vegetation.

Example Lead Arsenate Pesticide Maps

Two types of example lead arsenate pesticide maps are provided.

Type 1: Maps Based on County-Wide Application of the Individual Property Evaluation Flowchart

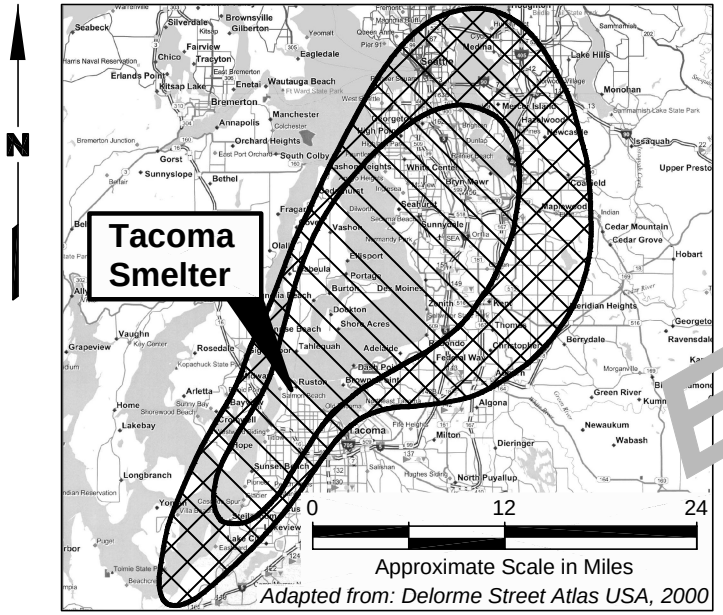
- Figures I-5, I-6, and I-7 show areas that may have been orchards historically based on county-wide applications of the land-use information in the individual property evaluation flowchart. They show areas in Chelan, Okanogan, and Yakima counties that are below 2,500 feet in elevation (2,000 feet for Yakima County) and that are not State, Federal, or tribal lands. With a few exceptions, fruit trees are not likely to have been grown on State and Federal public lands, or at higher elevations.

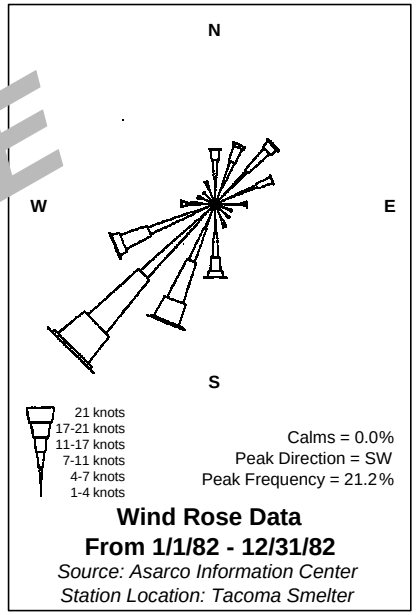
Type 2: Maps Based on Historical Aerial Photographs

- Figures I-8 and I-9 show the locations of orchards in Yakima County and in the Lake Chelan/Manson Area of Chelan County in 1947. These figures were developed by analyzing 1947 aerial photographs to identify the locations of historical orchards, entering this information into a geographic information system (GIS) database, and overlaying the locations of the historical orchards onto aerial photographs or other geographic data, such city and county boundaries and highways. Because apple and pear acreage was lower in these counties in 1947 than in previous years, these maps may fail to show lands that may be impacted by lead arsenate use.

These maps should not substitute for site-specific assessments. Maps show a greater or lesser probability of encountering arsenic and lead soil contamination based on proximity to historical sources, but individual property evaluations are needed to confirm if elevated levels of arsenic and lead are actually present. Due to the variability of the distribution of area-wide soil contamination, not all of the areas identified on the maps will actually have elevated levels of arsenic and lead in soil. Similarly, properties outside of areas identified on maps may contain elevated levels of arsenic and lead in soil.

Figure I-1: Estimate of Area Affected by Historical Tacoma Smelter Emissions with Wind Rose Diagram of Predominant Wind Directions at the Smelter Site (Based on Data Available as of January 2003)





Legend

Level 1: Area where shallow undisturbed soil likely exceeds 20 mg/kg Arsenic

Level 2: Area where shallow undisturbed soil occasionally exceeds 20 mg/kg Arsenic

Data Sources:
Ecology, 2002
Glass, 2002

Disclaimer

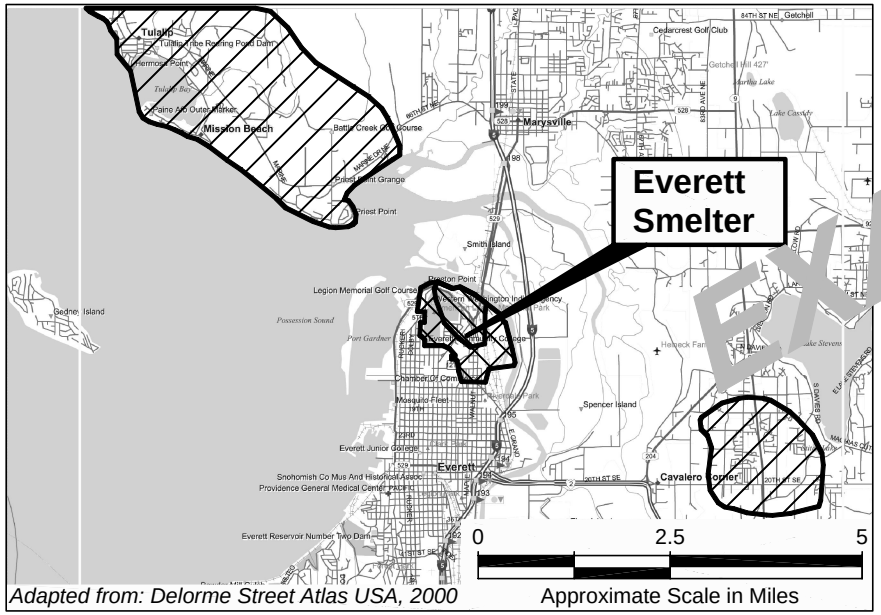
This map should not substitute for a site-specific assessment. Not all of the areas identified on the map will actually have elevated levels of arsenic and lead in soil. Some properties outside of the identified areas may have elevated levels of arsenic and lead in soil.

The map of the area affected by smelter emissions was originally developed in 2003 for the report "Area-wide Soil Contamination Project, Task 3.4: Preliminary Estimates." They are based on information available at that time and are intended to provide a general indication of where elevated levels of arsenic and lead in soil may be present due to historical smelter emissions, so individuals and communities can assess whether to look into additional information on area-wide soil contamination.

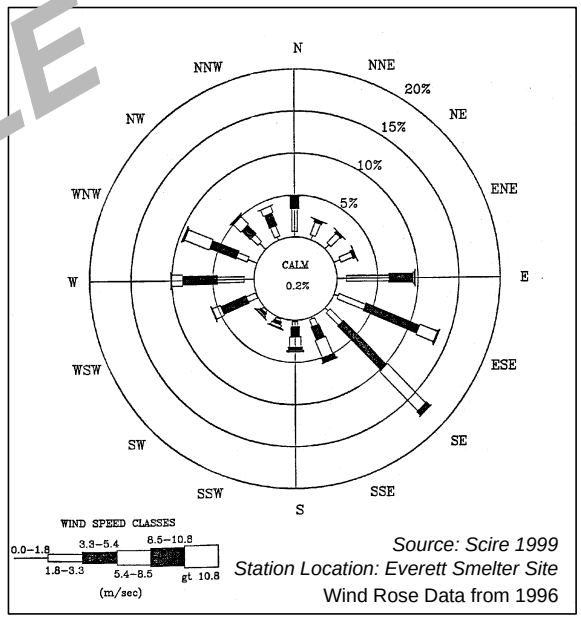
Interpreting a Wind Rose

A wind rose is a quantitative graphical summary of the wind direction and speed for a given time. The wind rose diagram shows the number of hours (expressed as a percentage) that the wind blew from a particular direction and speed. The wind rose spokes or arms represent 16 points of the compass. The length of each segment of a spoke represents the percentage of time the wind speed was within a specific speed interval for a particular direction (the longer the spoke, the greater the time that the wind blew from that direction). If summed for all wind directions, the result would provide the percentage of all hours the wind speed was measured within a specific interval. The percentage of time when the winds were light and variable is shown in the center of the rose.

Figure I-2: Estimate of Area Affected by Historical Everett Smelter Emissions with Wind Rose Diagram of Predominant Wind Directions at the Smelter Site (Based on Data Available as of January 2003)



Adapted from: Delorme Street Atlas USA, 2000



Source: Scire 1999
Station Location: Everett Smelter Site
Wind Rose Data from 1996

Legend

Level 1: Area where shallow soil likely exceeds 20 mg/kg Arsenic

Level 2: Area where shallow soil occasionally exceeds 20 mg/kg Arsenic

Level 3: Area where modeling predicted most likely particulate deposition from former furnace stack

Data Sources:
Ecology, 1999
Scire, 1999

Disclaimer

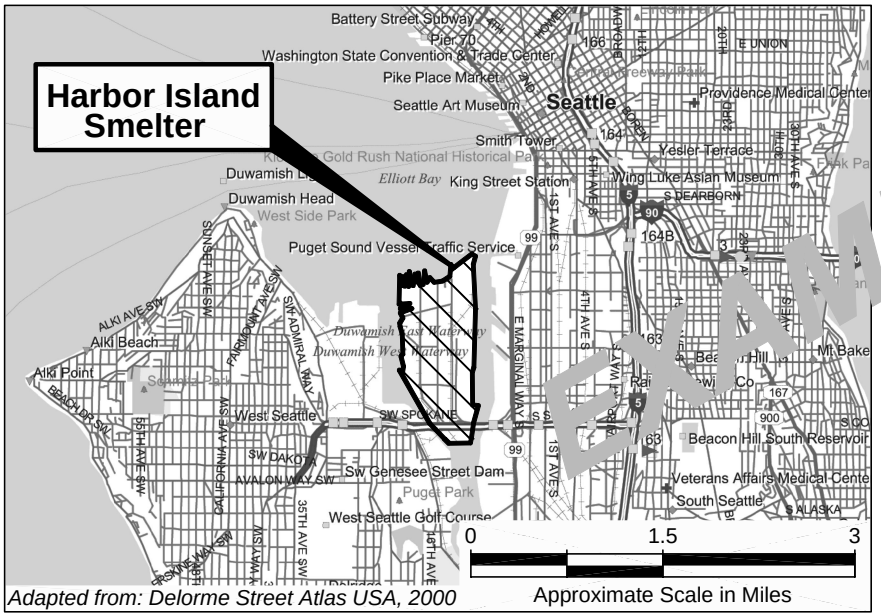
This map should not substitute for a site-specific assessment. Not all of the areas identified on the map will actually have elevated levels of arsenic and lead in soil. Some properties outside of the identified areas may have elevated levels of arsenic and lead in soil.

The map of the area affected by smelter emissions was originally developed in 2003 for the report "Area-wide Soil Contamination Project, Task 3.4: Preliminary Estimates." They are based on information available at that time and are intended to provide a general indication of where elevated levels of arsenic and lead in soil may be present due to historical smelter emissions, so individuals and communities can assess whether to look into additional information on area-wide soil contamination.

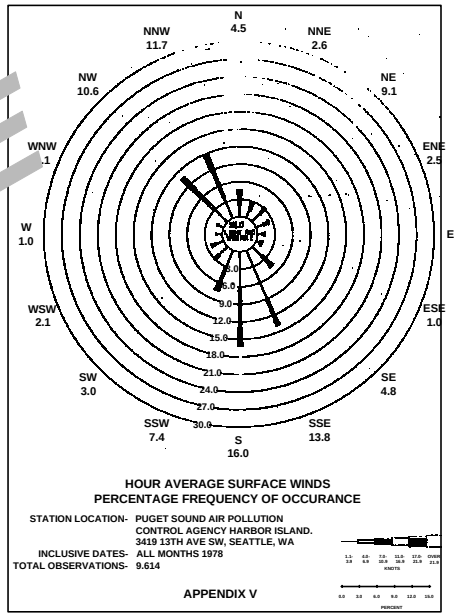
Interpreting a Wind Rose

A wind rose is a quantitative graphical summary of the wind direction and speed for a given time. The wind rose diagram shows the number of hours (expressed as a percentage) that the wind blew from a particular direction and speed. The wind rose spokes or arms represent 16 points of the compass. The length of each segment of a spoke represents the percentage of time the wind speed was within a specific speed interval for a particular direction (the longer the spoke, the greater the time that the wind blew from that direction). If summed for all wind directions, the result would provide the percentage of all hours the wind speed was measured within a specific interval. The percentage of time when the winds were light and variable is shown in the center of the rose.

Figure I-3: Estimate of Area Affected by Historical Harbor Island Smelter Emissions with Wind Rose Diagram of Predominant Wind Directions at the Smelter Site (Based on Data Available as of January 2003)



Adapted from: Delorme Street Atlas USA, 2000



Source: PSAPCA 1980
Station Location: Harbor Island

Legend

Level 1: Area where shallow soil likely exceeds 250 mg/kg Lead

Data Source:
Weston, 1993

Disclaimer

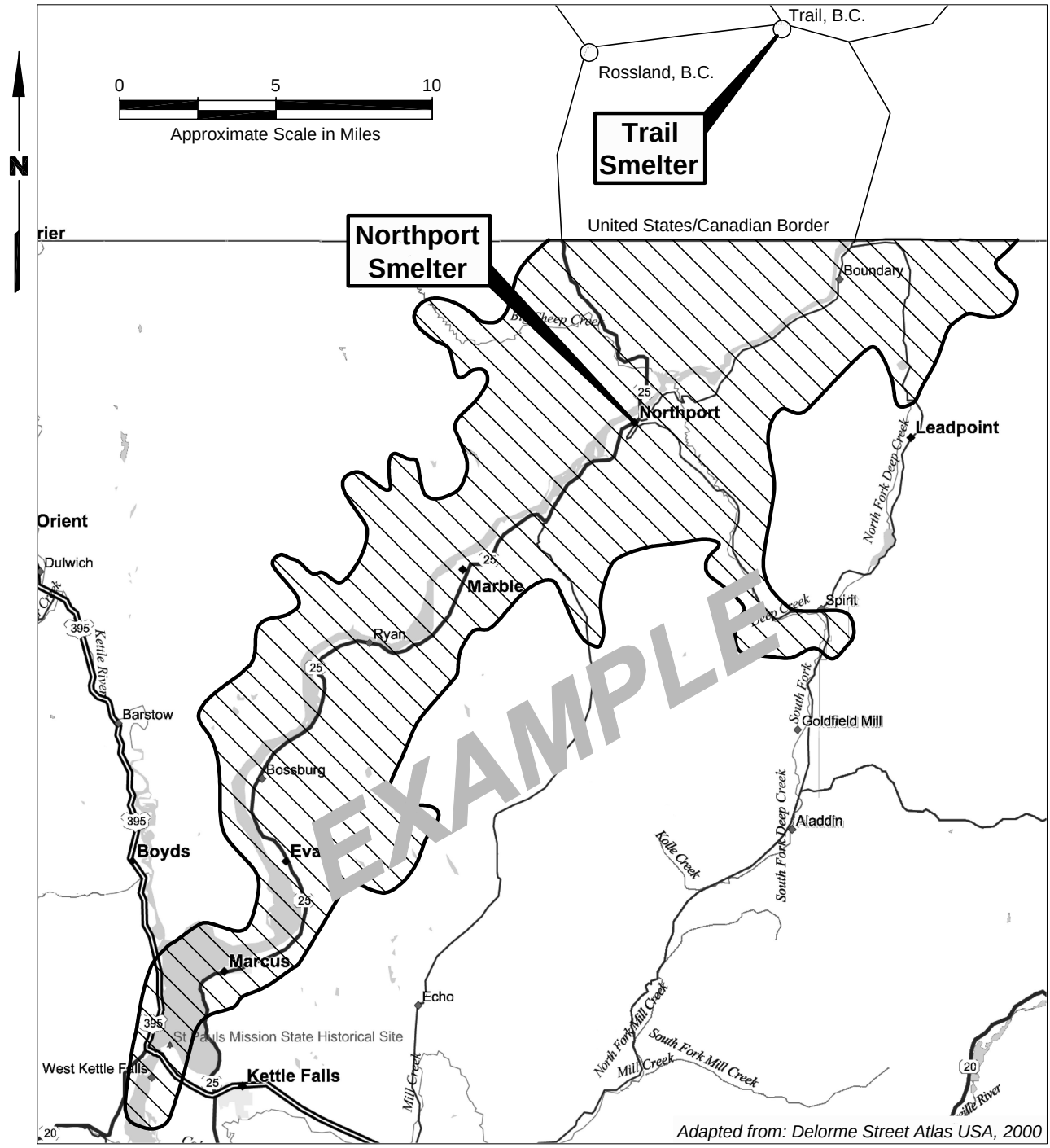
This map should not substitute for a site-specific assessment. Not all of the areas identified on the map will actually have elevated levels of arsenic and lead in soil. Some properties outside of the identified areas may have elevated levels of arsenic and lead in soil.

The map of the area affected by smelter emissions was originally developed in 2003 for the report "Area-wide Soil Contamination Project, Task 3.4: Preliminary Estimates." They are based on information available at that time and are intended to provide a general indication of where elevated levels of arsenic and lead in soil may be present due to historical smelter emissions, so individuals and communities can assess whether to look into additional information on area-wide soil contamination.

Interpreting a Wind Rose

A wind rose is a quantitative graphical summary of the wind direction and speed for a given time. The wind rose diagram shows the number of hours (expressed as a percentage) that the wind blew from a particular direction and speed. The wind rose spokes or arms represent 16 points of the compass. The length of each segment of a spoke represents the percentage of time the wind speed was within a specific speed interval for a particular direction (the longer the spoke, the greater the time that the wind blew from that direction). If summed for all wind directions, the result would provide the percentage of all hours the wind speed was measured within a specific interval. The percentage of time when the winds were light and variable is shown in the center of the rose.

Figure I-4: Estimate of Area Potentially Affected by Emissions from the Northport and Trail, BC Smelters (Based on Data Available as of January 2003)



Legend

Level 1: Area where smelter smoke damage to vegetation documented in 1929. Damage attributed to SO_2 emissions. Source: After Wirth, 2000

Disclaimer

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The map of the area affected by smelter emissions was originally developed in 2003 for the report "Area-wide Soil Contamination Project, Task 3.4: Preliminary Estimates." They are based on information available at that time and are intended to provide a general indication of where elevated levels of arsenic and lead in soil may be present due to historical smelter emissions, so individuals and communities can assess whether to look into additional information on area-wide soil contamination.

The area potentially affected by smelter emissions is only shown for Washington State, not Canada.

Figure I-5: Potential Historical Orchard Areas in Chelan County (Based on Use of the Individual Property Evaluation Flowchart)

Legend

- Areas where historical orchards may have been located
- Areas where historical orchards are not likely
- Cities
- Lakes
- Roads
- County line

Disclaimer

This map should not substitute for a site-specific assessment. Not all of the areas identified on the map will actually have elevated levels of arsenic and lead in soil. Some properties outside of the identified areas may have elevated levels of arsenic and lead in soil.

The areas potentially affected by historical use of lead arsenate pesticides shown in this map were determined by excluding State, Federal and Tribal land and areas with elevations greater than 2,500 feet from the area of the county because these areas are unlikely to have had apple or pear trees grown on them.

This map was developed in 2003 to support the Area-Wide Soil Contamination Task Force. It is based on information available at that time and is intended to provide a general indication of where elevated levels of arsenic and lead in soil may be present due to historical use of lead arsenate pesticides, so individuals and communities can assess whether to look in to additional information on area-wide soil contamination.

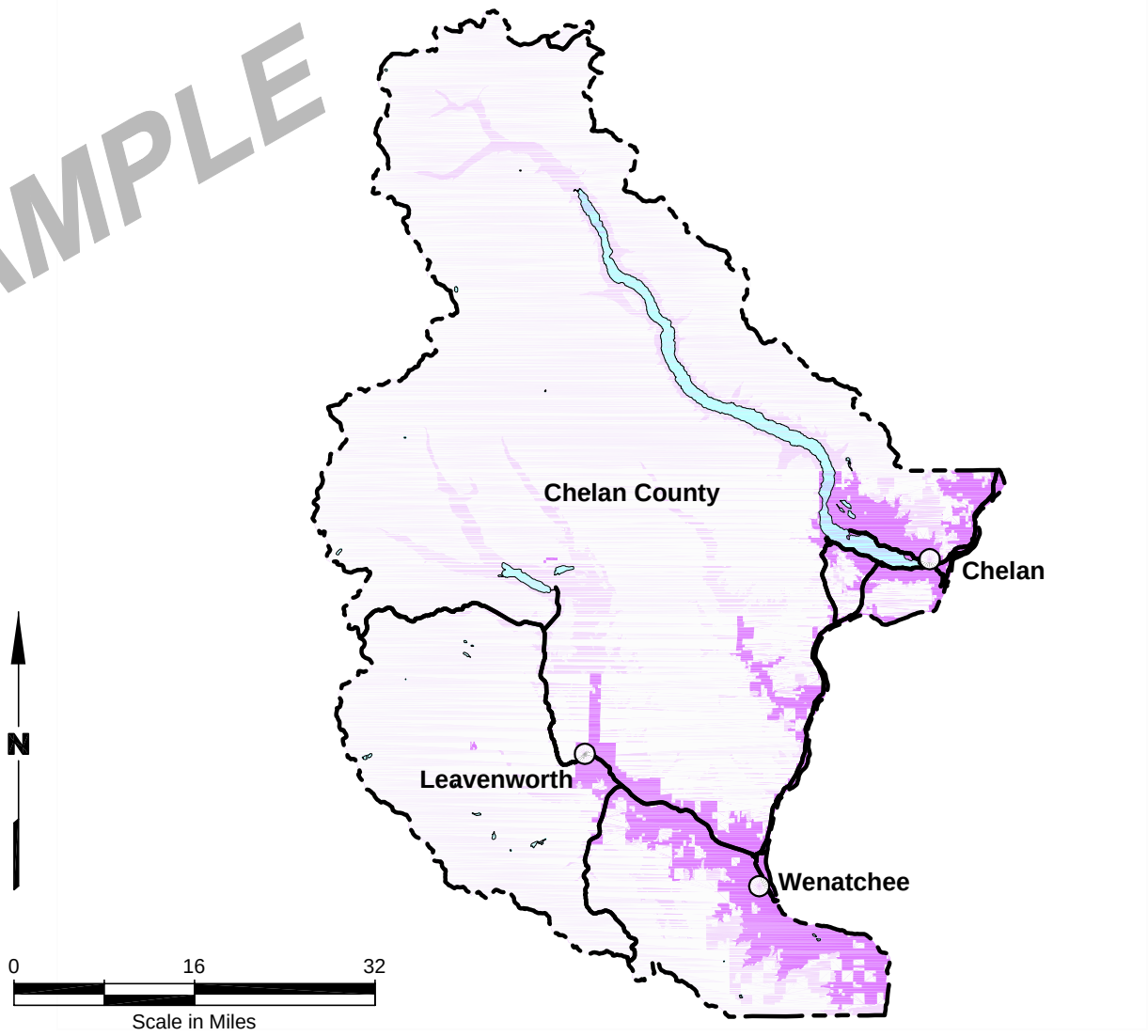


Figure I-6: Potential Historical Orchard Areas in Okanogan County
(Based on Use of the Individual Property Evaluation Flowchart)

Legend

- Areas where historical orchards may have been located
- Areas where historical orchards are not likely
- Cities
- Lakes
- Roads
- County line

Disclaimer

This map should not substitute for a site-specific assessment. Not all of the areas identified on the map will actually have elevated levels of arsenic and lead in soil. Some properties outside of the identified areas may have elevated levels of arsenic and lead in soil.

The areas potentially affected by historical use of lead arsenate pesticides shown in this map were determined by excluding State, Federal and Tribal land and areas with elevations greater than 2,500 feet from the area of the county because these areas are unlikely to have had apple or pear trees grown on them.

This map was developed in 2003 to support the Area-Wide Soil Contamination Task Force. It is based on information available at that time and is intended to provide a general indication of where elevated levels of arsenic and lead in soil may be present due to historical use of lead arsenate pesticides, so individuals and communities can assess whether to look in to additional information on area-wide soil contamination.

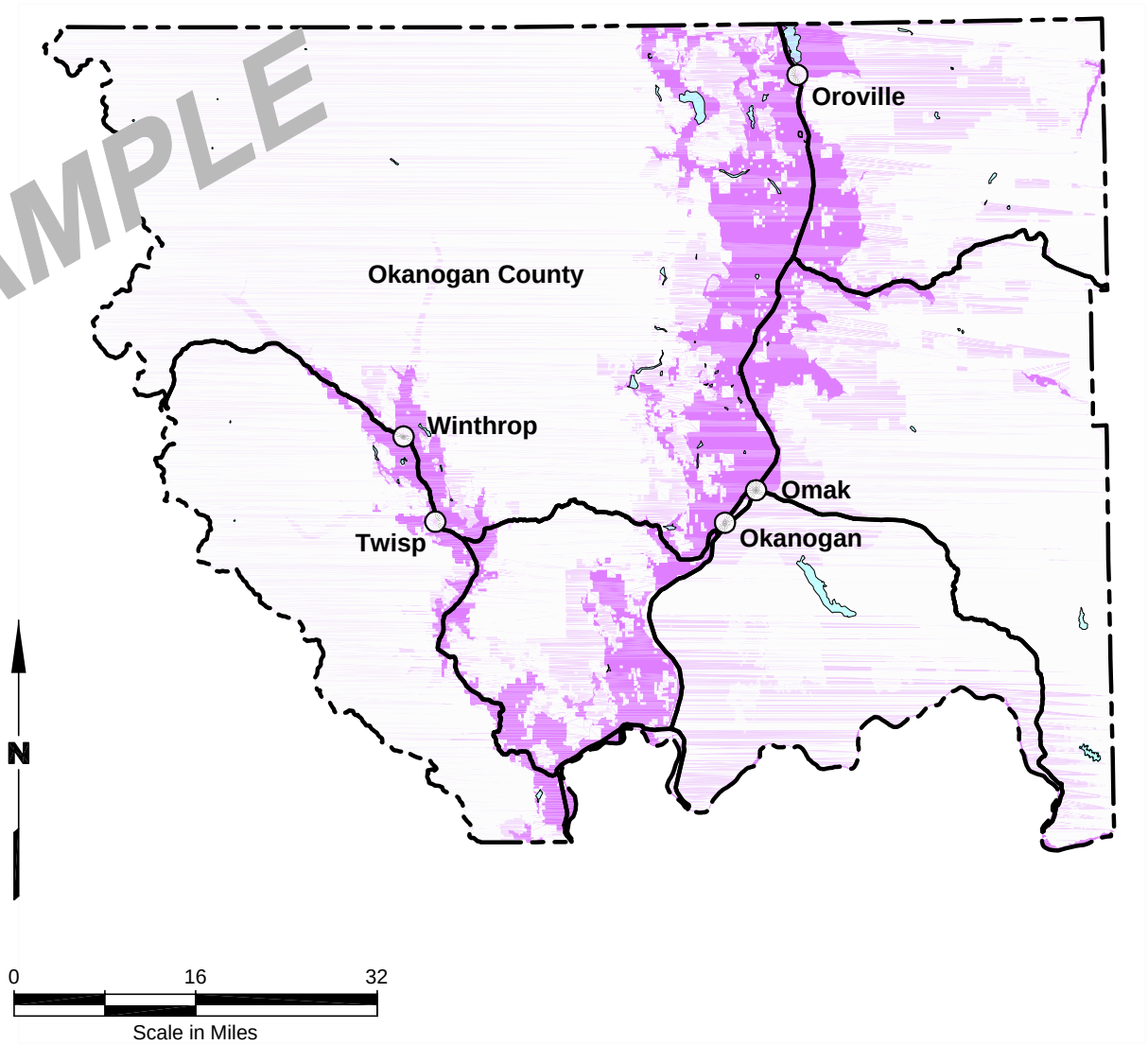


Figure I-7: Potential Historical Orchard Areas in Yakima County (Based on Use of the Individual Property Evaluation Flowchart)

Legend

- Areas where historical orchards may have been located
- Areas where historical orchards are not likely
- Cities
- Lakes
- Roads
- County line

Disclaimer

This map should not substitute for a site-specific assessment. Not all of the areas identified on the map will actually have elevated levels of arsenic and lead in soil. Some properties outside of the identified areas may have elevated levels of arsenic and lead in soil.

The areas potentially affected by historical use of lead arsenate pesticides shown in this map were determined by excluding State, Federal and Tribal land and areas with elevations greater than 2,000 feet from the area of the county because these areas are unlikely to have had apple or pear trees grown on them. An area west of Wapato where apple and pear trees have historically been grown is shown as potentially affected, even though it is Tribal property.

This map was developed in 2003 to support the Area-Wide Soil Contamination Task Force. It is based on information available at that time and is intended to provide a general indication of where elevated levels of arsenic and lead in soil may be present due to historical use of lead arsenate pesticides, so individuals and communities can assess whether to look in to additional information on area-wide soil contamination.

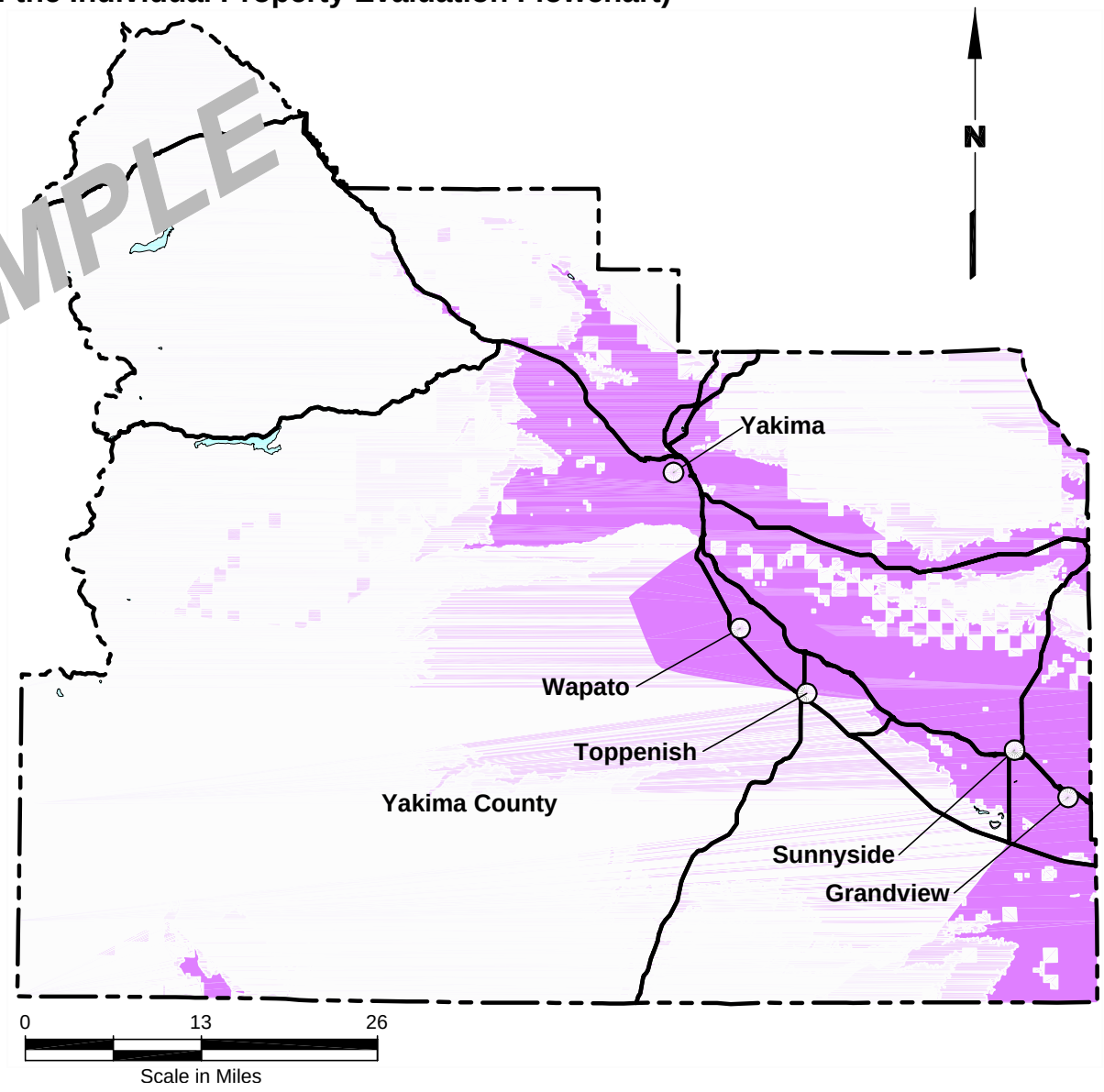
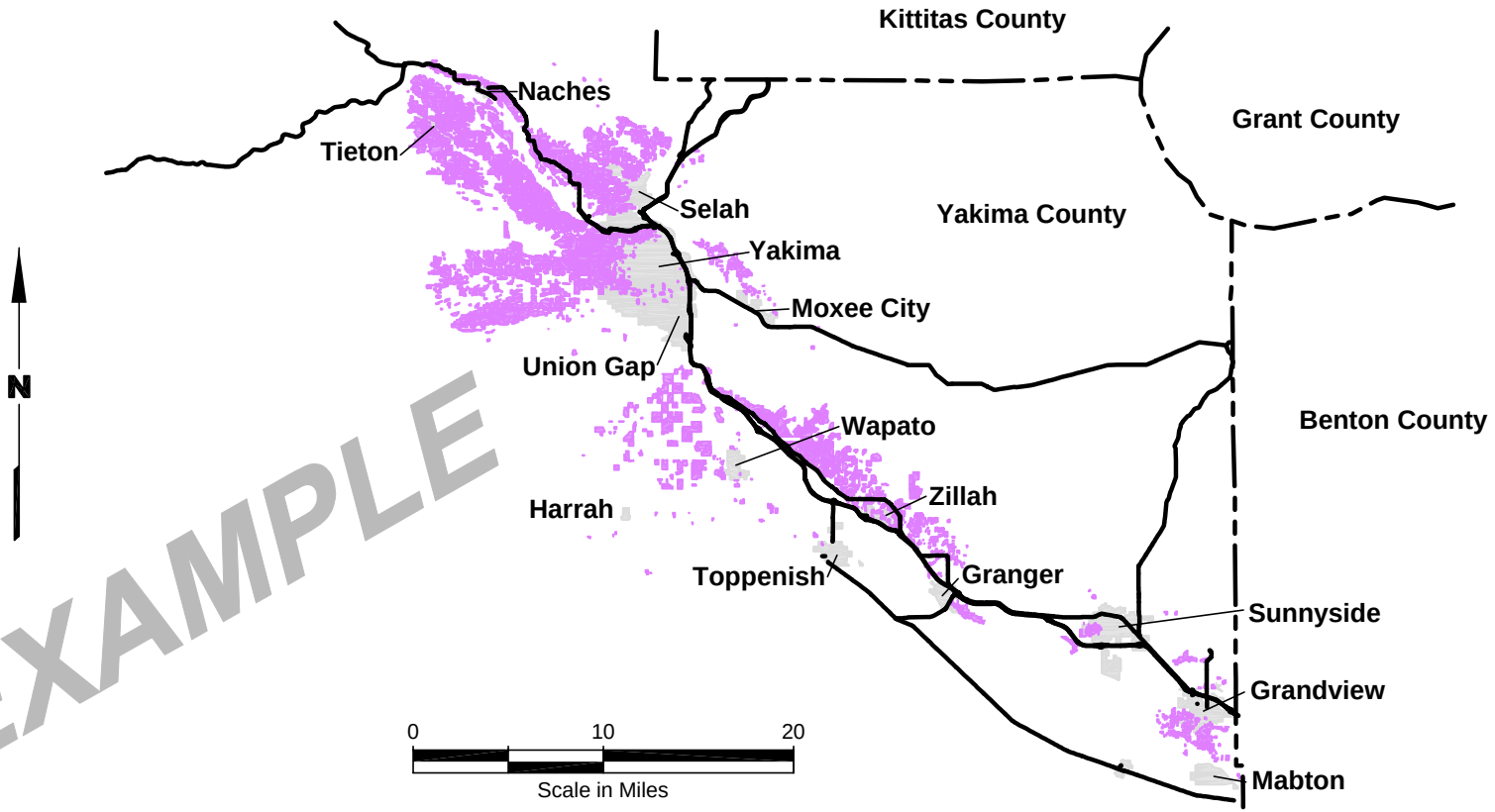


Figure I-8: Historical Orchards in Yakima County Circa 1947



Legend

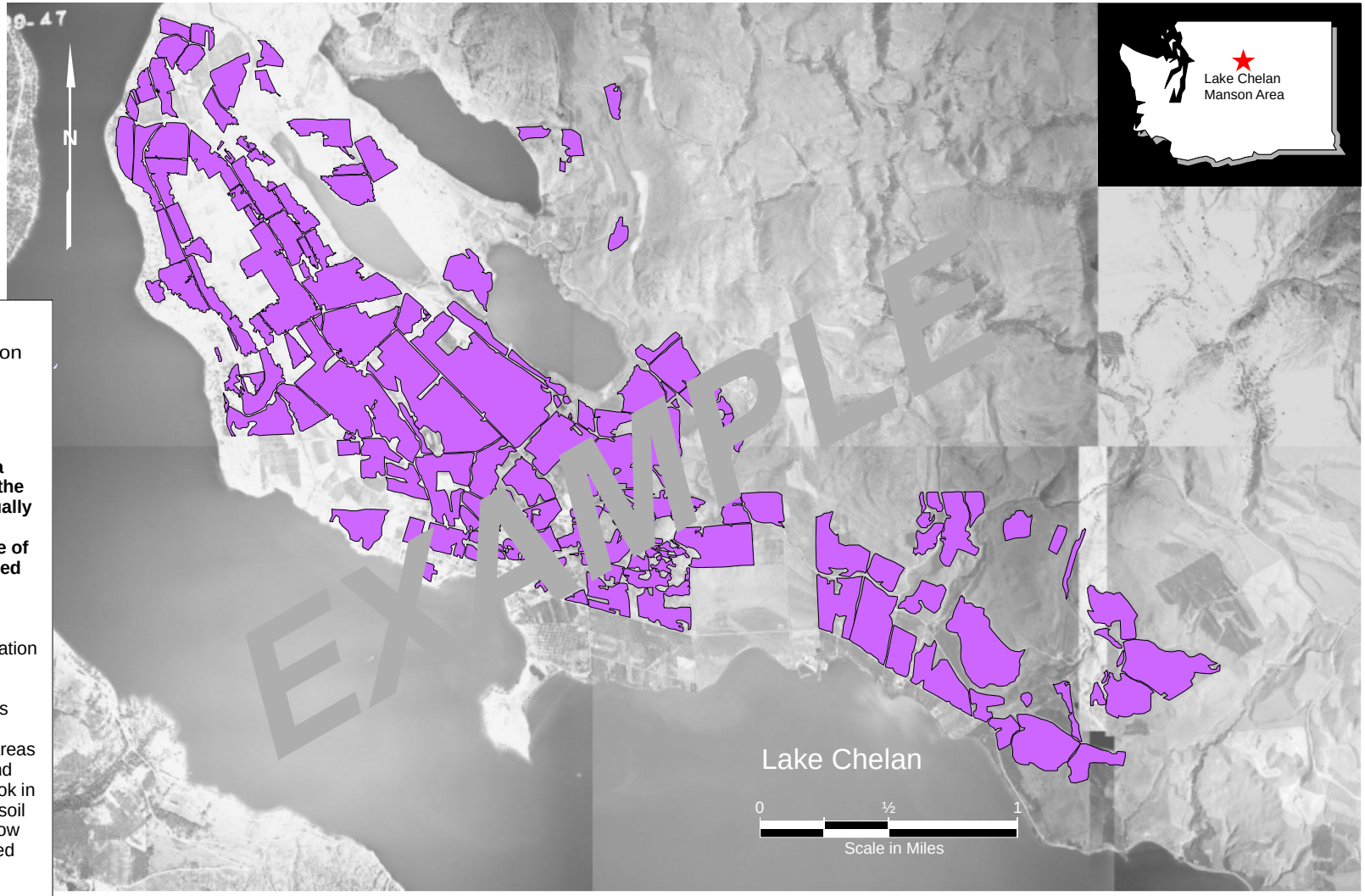
- State or federal roads
- 1947 Orchard lands
- Cities

Disclaimer:

This map should not substitute for a site-specific assessment. Not all of the areas identified on the map will actually have elevated levels of arsenic and lead in soil. Some properties outside of the identified areas may have elevated levels of arsenic and lead in soil.

This figure was originally developed in 2000 by the Yakima County Geographic Information Services. It is based upon an analysis of historical aerial photographs and is intended to provide a general indication of where historical orchard areas were located in 1947, so individuals and communities can assess whether to look in to additional information on area-wide soil contamination. This figure does not show the location of all orchards that operated during the period when lead arsenate pesticides were used, 1905-1947.

Figure I-9: Historical Orchards in the Lake Chelan/Manson Area of Chelan County Circa 1947



Legend

Historic orchards, based on 1947 aerial photographs

Disclaimer

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This figure was originally developed in 2003 for the "Area-wide Soil Contamination Project, Task 3.12: Manson Area Data Analysis" report. It is based upon an analysis of historical aerial photographs and is intended to provide a general indication of where historical orchard areas were located in 1947, so individuals and communities can assess whether to look in to additional information on area-wide soil contamination. This figure does not show the location of all orchards that operated during the period when lead arsenate pesticides were used, 1905-1947.